

diovascular support based on cardiac preload and afterload assessment. The risk of barotrauma should be minimized by ensuring that increments of PEEP are not associated with increases in peak inspiratory pressure.

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#### REFERENCES

- Wayne KS: Positive end-expiratory pressure (PEEP) ventilation—A review of mechanisms and actions. *JAMA* 236:1394-1396, Sep 20, 1976
- Leftwich E, Witorsch RJ, Witorsch P: Positive end-expiratory pressure in refractory hypoxemia—A critical evaluation. *Ann Intern Med* 79:187-193, Aug 1973
- Suter PM, Fairley B, Isenberg MD: Optimum end-expiratory pressure in patients with acute pulmonary failure. *N Engl J Med* 292:284-289, Feb 6, 1975
- Kirby RR, Downs JB, Civetta JM, et al: High level positive end-expiratory pressure (PEEP) in acute respiratory insufficiency. *Chest* 67:156-163, Feb 1975
- Gallagher TJ, Civetta JM, Kirby RR: Terminology update: Optimal PEEP. *Crit Care Med* 6:323-326, Sep-Oct, 1978

## Current Status of Surgical Therapy in Lung Cancer

ALTHOUGH RESULTS of surgical resection have not changed much in the past decade, the procedure remains the best hope for long-term survival of patients with lung cancer. When patients with lung cancer are first seen the disease will be unresectable in most cases. Of patients in whom resection is thought to be curative, only a third will survive five years. For all patients in whom lung cancer is diagnosed, fewer than 10 percent will be alive five years later. The yield from surgical therapy may not have improved substantially, but physicians are now better able to decide if surgical operation, radiation therapy, chemotherapy or general supportive care should be used.

A physician seeing a patient with presumed lung cancer must answer a series of questions. First, is the lesion cancer or another disease? Various diagnostic techniques, such as tomography, can help establish the probable nature of a lesion. However, only histological characterization can definitely resolve this issue. Cytological studies of sputum, material obtained through flexible bronchoscopy or specimens obtained with percutaneous needle aspiration should yield an answer in up to 90 percent of cases. The physician must next determine if the lesion can be totally removed surgically; if residual or metastatic disease remains, death may be hastened or the quality of survival degraded. There is a rational approach to the search for metastatic lesions; not every test need be done in every patient. In about half of patients, the disease is unresectable because the tumor extends into the mediastinum. Introduction of mediastinoscopy and mediastinotomy has reduced the occurrence of exploratory

thoracotomy *without resection* from about 50 percent to 10 percent or 20 percent.

In some patients, complicating diseases render the risk of surgical operation unacceptable. Inoperability due to chronic obstructive lung disease is also a frequent problem, but careful assessment of pulmonary function can help with the decision to operate or not. If after an appropriate and expeditious evaluation, all the questions are resolved in favor of operation or the lesion's true nature is still unknown, thoracotomy should be done promptly. In such cases there is a good chance for prolonged survival and this usually more than balances the risks engendered by the preoperative workup.

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#### REFERENCES

- Mittman C, Bruderman I: Lung cancer: To operate or not? *Am Rev Respir Dis* 116:477-496, Sep 1977
- Selawry OS, Strauss MJ (Ed): Lung cancer. *Semin Oncol* 1: 161-289, 1974

## Practical Applications of Wet-Mount Sputum Preparations

A COMMON DILEMMA facing physicians caring for a patient with chronic obstructive pulmonary disease is what to do when the patient's sputum turns yellow-green. Ordinarily, the physician prescribes an antimicrobial agent assuming that a respiratory infection has developed. However, one cannot distinguish an infectious from an allergic sputum by its color alone. Sputum color change to green or yellow is a result of an enzyme (myeloperoxidase) in association with cellular breakdown during stasis. The yellow-green color, therefore, tends to signify retained or stagnant secretions. A wet-mount preparation of the sputum can be useful in differentiating between allergic and infectious problems. A wet-mount specimen is prepared by teasing a small particle of mucus from the sputum specimen and placing it on a slide. A drop of crystal violet solution may be added and a cover slip is pressed down over the preparation. The slide is then examined through a microscope to determine whether the predominant cells are neutrophils (indicative of infection) or eosinophils (indicative of allergy). A Wright stain can be used to determine the same information; however, the wet-mount preparation is quicker and can be done easily in the physician's office.

If the sputum contains predominantly neutrophils, the condition will very likely respond to an antimicrobial agent. However, if the sputum is loaded with eosinophils, administration of a corticosteroid is the treatment of choice. In an out-

patient, it seems appropriate empirically to start antimicrobial therapy if the patient's sputum increases in amount, becomes thicker or turns yellow-green. However, if there is no satisfactory response in 48 to 72 hours, a sputum wet-mount examination is indicated. The patient may have a respiratory infection and the antimicrobial agent selected may not have affected the causative organism. It can also be determined if the increased sputum difficulty is not related to an infection but, in fact, is a manifestation of allergy.

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#### REFERENCES

- Chodosh S: Examination of sputum cells. *N Engl J Med* 282: 854-857, Apr 9, 1970  
Epstein RL: Constituents of sputum: A simple method. *Ann Intern Med* 77:259-265, Aug 1972

### Weaning Criteria for Patients on Mechanical Respiratory Assistance

IN ORDER to understand the criteria that commonly are used to determine whether patients are ready for weaning from mechanical ventilation, it is necessary to review some of the physiologic changes that may occur in those who are successfully weaned. During the first day off a ventilator there is usually a 50 percent rise in vital capacity, the tidal volume increases by about 1 ml per kg of body weight and the patient's spontaneous maximum inspiratory force increases by 6 cm of water. There is little change in the lung compliance, functional residual capacity or dead space-to-tidal volume ratio ( $V_D/V_T$ ). Invariably, there is a transient rise in the arterial carbon dioxide pressure. A small rapidly developing increase in right-to-left shunt occurs, which is reflected in a widening of the alveolar-to-arterial oxygen tension difference ( $A-a D_{O_2}$ ). In some patients there is a rise in the cardiac output; in others it falls. Significant changes in pulse and blood pressure are rarely seen. Most patients also experience some degree of sympatho-adrenal stimulation.

Many of the commonly used criteria are good predictors of successful weaning because they reflect the magnitude of these physiologic changes. The patient's underlying disease, which led to respiratory failure and mechanical ventilatory support, influences which criteria may be helpful in predicting that the time for weaning has arrived.

In general, the criteria for discontinuance are the reverse of the criteria for beginning mechanical ventilatory assistance. In patients with neuromuscular disease, a vital capacity of at least 10 ml per kg of body weight, or in adults at least 1.0 liter, and a maximum inspiratory force of at least

—20 cm of water are desirable. In the acute hypoxic states—such as noncardiogenic pulmonary edema, aspiration pneumonia or fat embolism—a system compliance of at least 30 ml per cm of water, and  $\Delta A-a_{O_2}$  of less than 200 mm of mercury (fraction of inspired oxygen, 1.0) or an arterial oxygen pressure-to-fraction of inspired oxygen ratio of at least 200 are desirable. In patients with obstructive airways the fraction of inspired oxygen, a spontaneous minute ventilation of less than 10 liters per minute, which can be doubled with effort, and a maximum inspiratory force of at least —20 cm of water probably indicate that weaning can commence. During spontaneous breathing the arterial carbon dioxide pressure should not rise faster than 2.0 mm of mercury per minute. In most instances of respiratory failure, the recovering  $V_D/V_T$  should usually be less than 0.6. Observation of vital signs after discontinuance of mechanical assistance is also important. The heart rate should not exceed about 120 per minute and the mean arterial blood pressure should not rise by more than 15 mm of mercury. No worsening of cardiac arrhythmia should occur. Greatly increased metabolic rates, as seen in patients with high fever, or abnormalities of electrolytes may also make weaning difficult.

It should be stressed that none of these criteria are absolute predictors. It is not easy to accurately assess diaphragm function, metabolic work and cardiac function at the bedside. Therefore, these criteria are guidelines. They should alert a physician to the likelihood of success or failure in weaning a patient but they should not necessarily deter initiating an attempt to restore patient support of respiration.

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#### REFERENCES

- Hedley-Whyte J, Burgess GE, Feeley TW, et al: *Applied Physiology of Respiratory Care—Criteria of Weaning*. Boston, Little, Brown Co., 1976, pp 136-138  
Hodgkin JE, Bowser MA, Burton GG: Variation in the occurrence of extracellular diffusible antigens in temperature-induced variants of *Erwinia herbicola* Y46, and observations of their relationships with *Erwinia amylovora*. *Crit Care Med* 2:96-102, Mar-Apr 1974  
Skillman JJ, Malhotra IV, Pallotta JA, et al: Determinants of weaning from controlled ventilation. *Surg Forum* 22:198-200, 1971

### Biofeedback in Pulmonary Diseases

DYSPNEA, carbon dioxide retention and persistent dry cough are problems in pulmonary management particularly suited to ancillary therapy with biofeedback. In each instance, patients' own instinctive adaptive responses—work harder to breathe, breathe faster and really try to force out the irritant—only serve to aggravate and perpetu-